Medicinal Organic Chemistry and Drug Design

By

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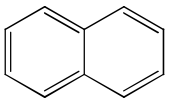
Polynuclear hydrocarbons

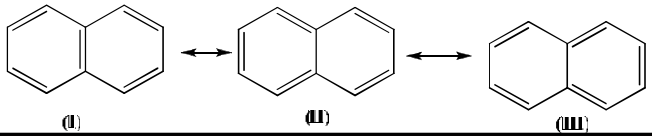
Polynuclear hydrocarbons may be divided into two groups, those in which the rings are isolated, e.g., biphenyl, diphenylmethane, etc.; and those in which two or more rings are fused together in the o-positions, e.g., naphthalene, anthracene, etc.

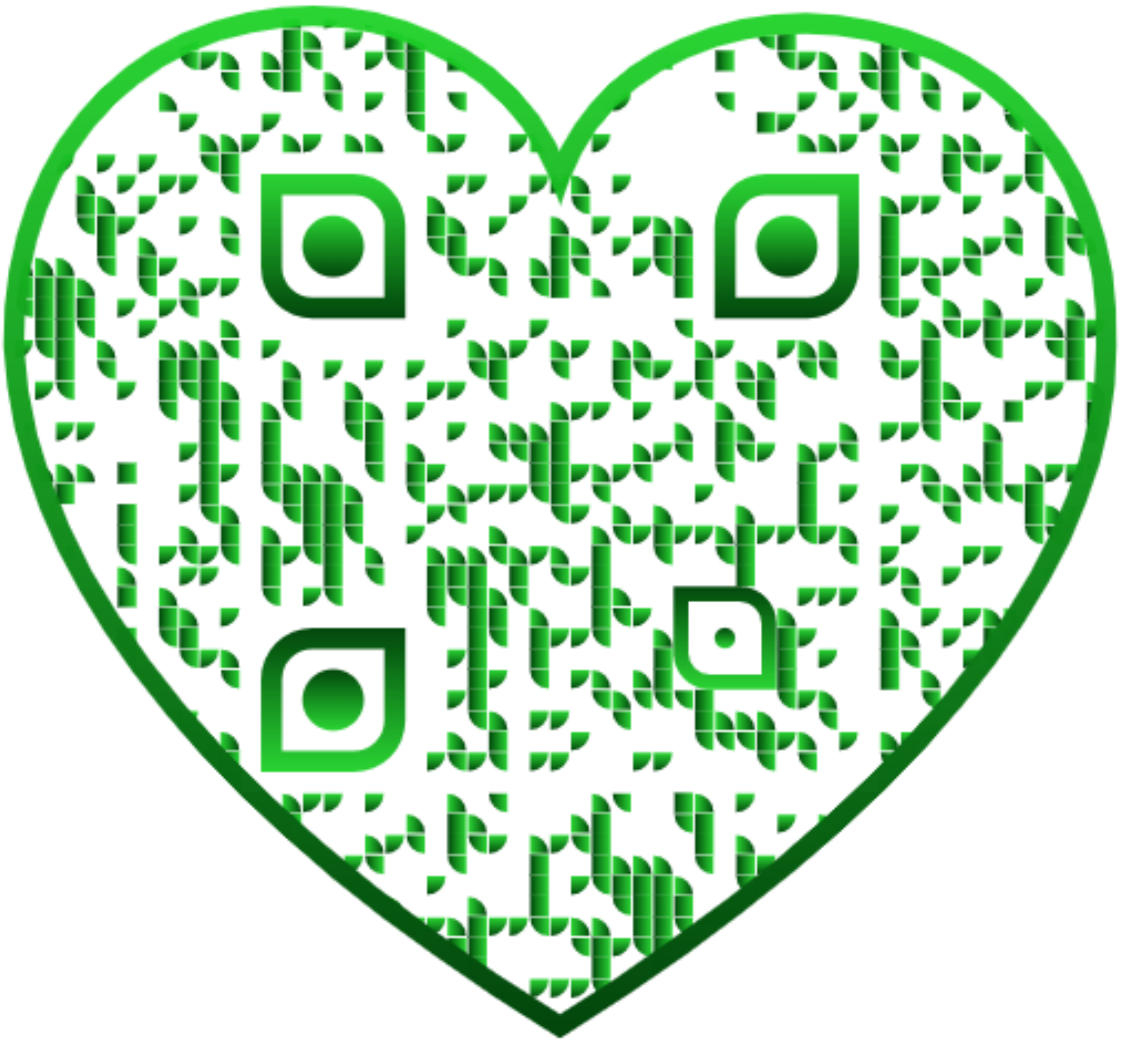
Condensed systems Naphthalene:

Naphthalene is also now being made synthetically from petroleum.

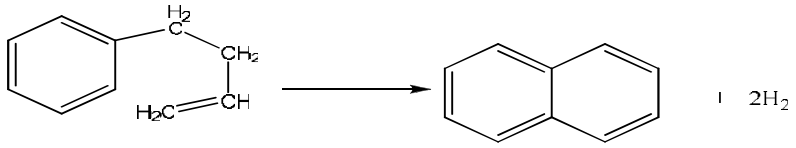
Structure of naphthalene:



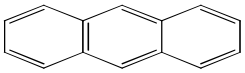




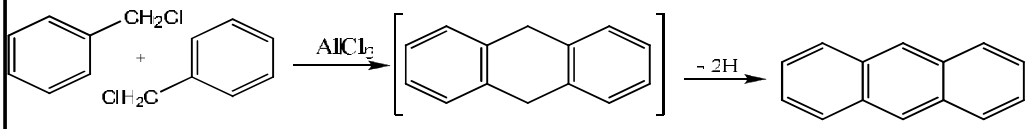
This structure for naphthalene has been confirmed by many syntheses, e.g.: (I) when 4-phenylbut-I-ene is passed over red-hot calcium oxide, naphthalene is formed:



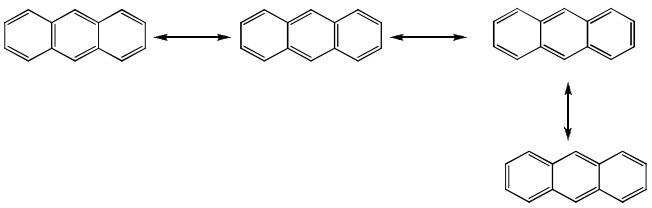
Anthracene
Anthracene, $C_{14}H_{10}$



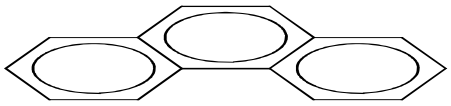
Synthesis of anthracene



Positions of the double bonds in anthracene:
Anthracene is best regarded as a resonance hybrid of four resonating structures:



Phenanthrene:
Phenanthrene, $C_{14}H_{10}$, is isomeric with anthracene; it is an example of an angular polynuclear hydrocarbon.



Name of Heterocyclic Compounds

IUPAC Nomenclature of Monocyclic Heterocycles:

2- IUPAC (systematic or chemical) names:

To-day, the system employed for naming heterocycles, is given by the **International Union of Pure and Applied Chemistry (IUPAC)**

The following is a summary of the IUPAC rules:

1-The IUPAC (or systematic) name consists of one or more **prefixes from table 1** with multipliers when needed designating the heteroatoms followed by a **stem + suffix from table 2** which give the ring size and unsaturation. This is preceded by substituents.

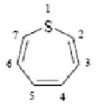
Table (1) Hantzsch-Widman system prefixes (in decreasing order of seniority)

Element	Bonding number (Valence)	Prefix
Oxygen	**2**	**oxa**
Sulfur	**2**	**thia**
Selenium	2	selena
Nitrogen	**3**	**aza**
Phosphorus	**3**	**phospha**
Arsenic	3	arsa
Silicon	4	Sila
Boron	3	Bora

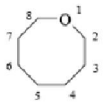
Ring Size	Unsaturated	Saturated	Ring Size	Unsaturated	Saturated
3	**irene/irine**	**irane/iridine**	**7**	**epine**	**Epane**
4	**ete**	**etane/etidine**	**8**	**ocine**	**Ocane**
5	**ole**	**olane/olidine**	**9**	**onine**	**Onane**
6A	**ine**	**ane**	**10**	**ecine**	**Ecane**
6B	**ine**	**inane**			
6C	**inine**	**inane**			

A (O, S, Se) B (B, N) C (P, As, Si)

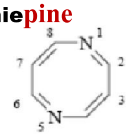
Examples:



thiepine



oxocane



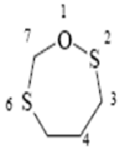
1,5-diazocine

1,3-dioxolane

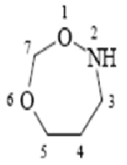
1,3-thiazole

1,2-oxathiolane

2- If two or more kinds **of heteroatoms** occur in **the same name,** their order of citation follows the sequence of seniority in table (1). **Numbering begins with the element highest** in table (1) (i.e**. O > S > N)** and continues in the **direction that gives the lowest number** to the next heteroatom



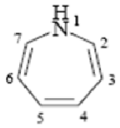
1,2,6-oxadithiepane



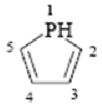
1,6,2-dioxazepane

3-The symbols **1*H*, 2*H*** ..... etc are used to indicate saturation of a single position (indicated H). If the number of double bonds is less than maximum, prefixes **dihydro, tetrahydro** ....etc. are used with the name of the unsaturated compound.

Examples:



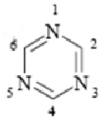
1*H*-aze**pine**



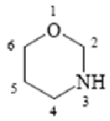
1*H*-phosph**ole**

2*H*-1,3-diox**ole**

six-membered rings



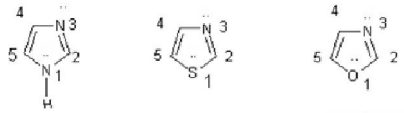
1,3,5-tri**azine**



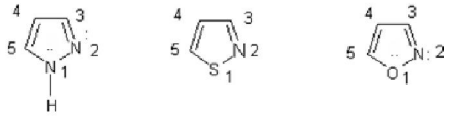
1,3-oxaz**inane**

A- Unsaturated 5- membered rings:

Pyrrol (1*H*- azole) | **thiophene** (thiole) | **Furan** (*ox*ole)

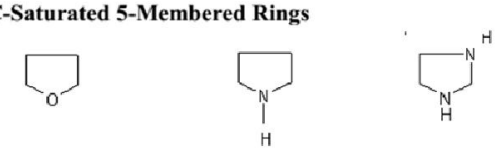


Imidazole 1*H*-1,3-diazole | **thiazole** 1,3-thiazole | **oxazole** 1,3-oxazole

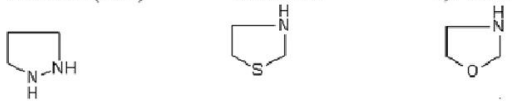


Pyrazole 1,2-diazole | **isothiazole** 1,2-thiazole () | **isoxazole** 1,2-oxazole ()

C-Saturated 5-Membered Rings



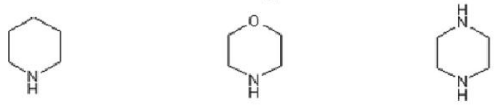
Tetrahydrofuran Oxolane (PIN) | Pyrrolidine (PIN) azolidine | Imidazolidine(PIN) 1,3-diazolidine



Pyrazolidine(PIN) 1,2-diazolidine | thiazolidine 1,3-thiazolidine (PIN) | oxazolidine 1,3-oxazolidine(PIN)

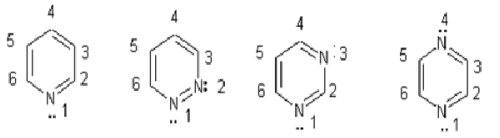
Isothiazolidine 1,2-thiazolidine (PIN) | isoxazolidine 1,2-oxazolidine(PIN)

D-Saturated 6-membered rings



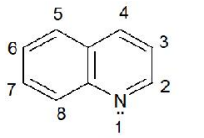
Piperidine (PIN) | morpholine(PIN) | piperazine (PIN)

B- Unsaturated 6-membered rings:

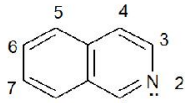


Pyridine () Pyridazine () Pyrimidine () Pyrazine ()

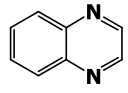
Azine 1,2-diazine 1,3-diazine 1,4-diazine



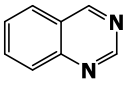
Quinoline



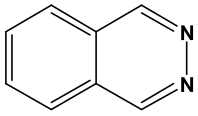
isoquinoline



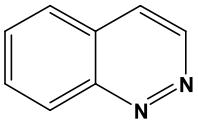
Quinoxaline



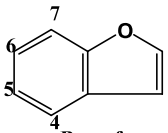
Quinazoline



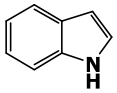
phthalazine



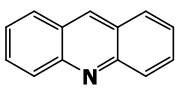
cinnoline



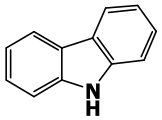
Benzofuran



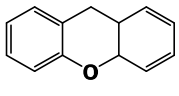
Indole



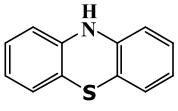
Acridine



Carbazole



xanthene

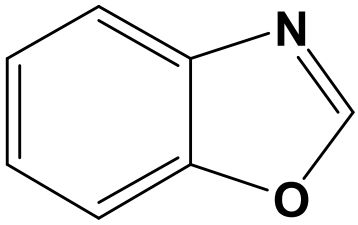


phenothiazine

Nomenclature of heterocyclic compounds

Prefix + Base component

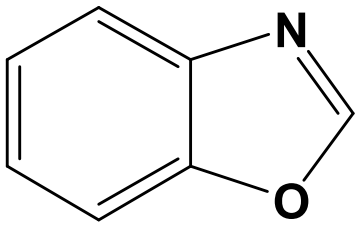
Oxazolobenzene or benzooxazolole



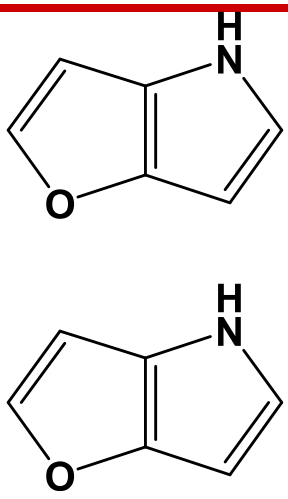
Benzooxazole

Base component

1. One ring only contain nitrogen ,we choose it.



Benzooxazole



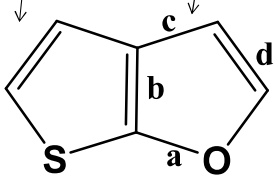
Furo[3,2-b]pyrrole

If the hetrocyclic become prefix ,they are some modification in their name

hetero	**prefix**	**hetero**	**prefix**
benzene	**benzo**	**thiophen**	**thieno**
furan	**furo**	**pyroll**	**pyrolo**
isoxazol	**isoxazolo**	**Pyridine**	**pyrido**
imidazol	imidazo	pyrimidine	pyrimido

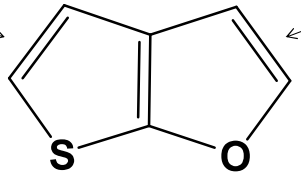
2. No Nitrogen , oxa then thia

prefix base



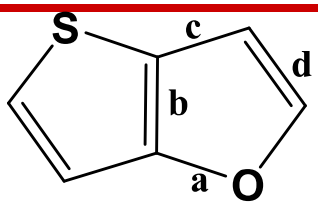
Thieno furan

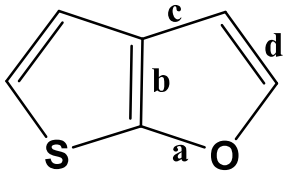
prefix base



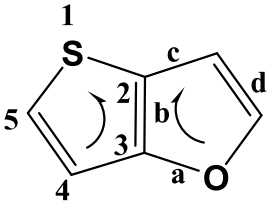
Thieno furan

2. No Nitrogen , oxa then thia



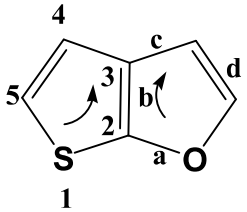


Thieno b- furan



Thieno-3,2 - b furan

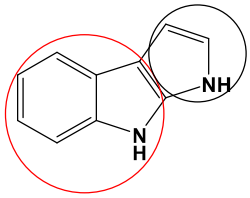
Thieno[3,2-b]furan

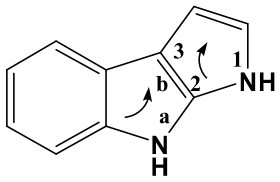


Thieno-2,3- b furan

Thieno[2,3-b]furan

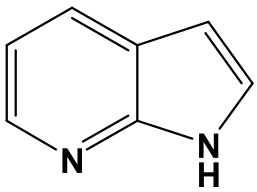
3. One consists of two or more rings , choose it



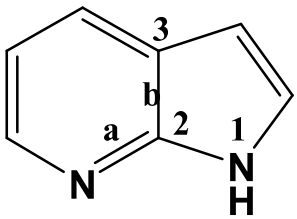


payrolo[2,3-b]indol

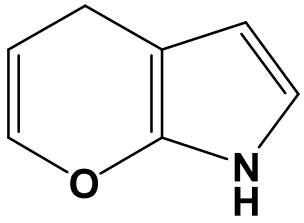
4. Two rings of two different size choose the larger



Pyrrolo[2,3-b]pyridine

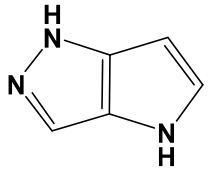


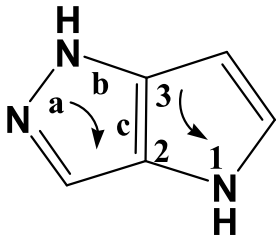
Pyrrolo[2,3-*b*]pyridine



pyrano[2,3-b]pyrrole

5. Choose the one of more heteroatoms





pyrrolo[3,2-c]pyrazole

6.The same number of heteroatoms ,we choose

Oxa > thia > aza

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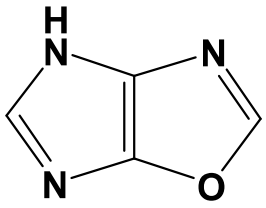
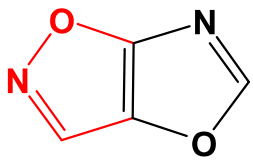


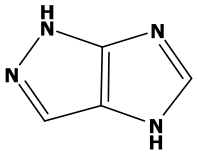
Imidazo 4,5 d oxazol

Imidazo[4,5-d]oxazole

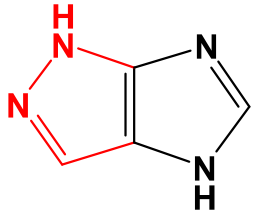
7, The same number heteroatoms,choose oxa > Thia > aza, then choose the lower number.



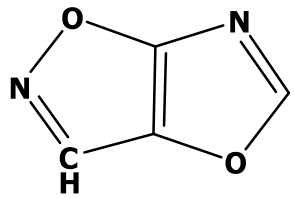
Oxazolo[5,4-d]isoxazole



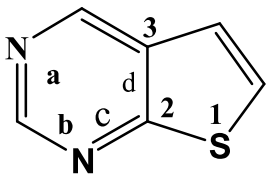
1,4-Dihydro-imidazo[4,5-*c*]pyrazole

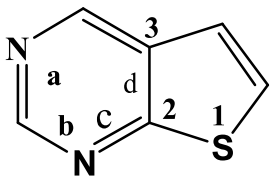


imidazo[4,5-C]pyrazole

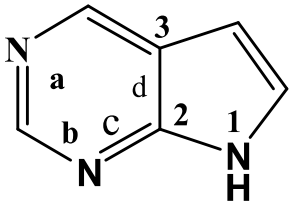


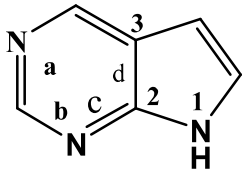
Oxazolo[5,4-*d*]isoxazole



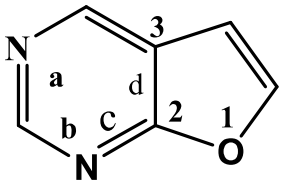


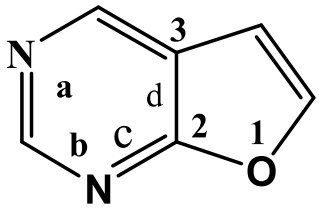
Thieno[2,3-*d*]pyrimidine



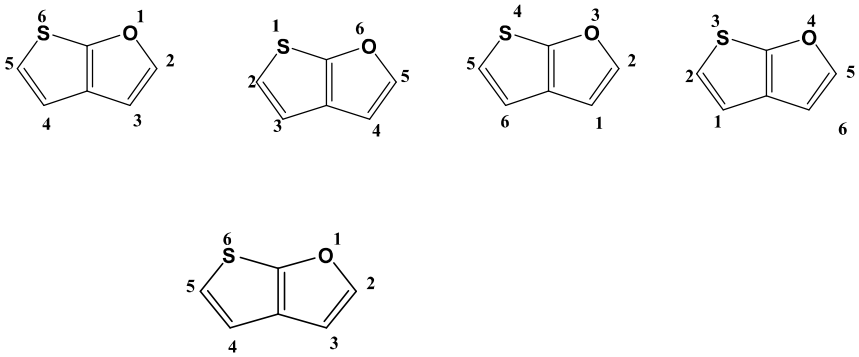


Pyrrolo[2,3-*d*]pyrimidine



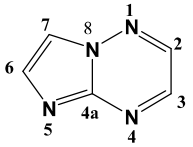


Furo[2,3-*d*]pyrimidine

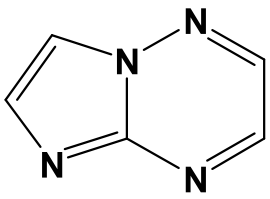


Thieno[2,3-*b*]furan

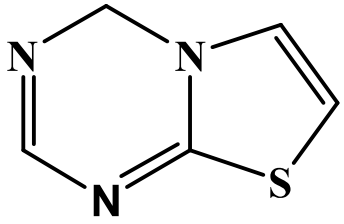
c. Give the low number for carbon fusion

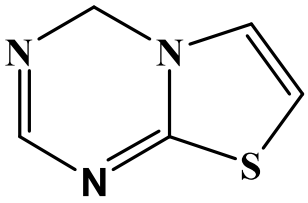


Imidazo[1,2-*b*][1,2,4]triazine



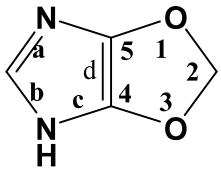
Imidazo[1,2-*b*][1,2,4]triazine

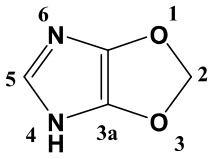




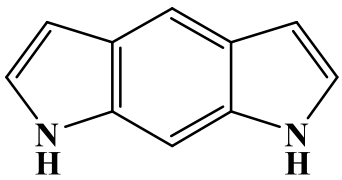
Thiazolo[3,2-*a*][1,3,5]triazine

d. Give the lower number for saturated carbon

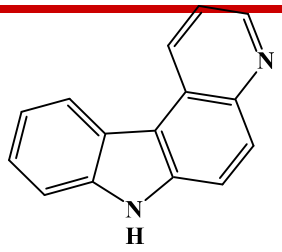




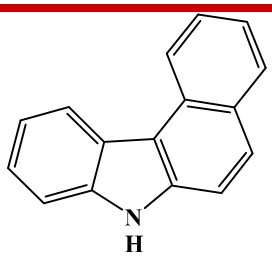
2H,4H, 1,3 di oxalolo[4,5-d] imidazol



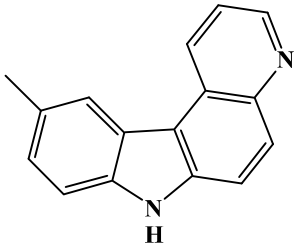
1,7-Dihydro-pyrrolo[3,2-*f*]indole



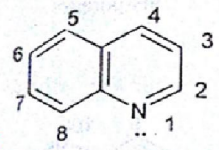
7*H*-Pyrido[2,3-*c*]carbazole



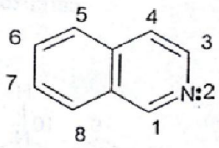
7*H*-Benzo[*c*]carbazole



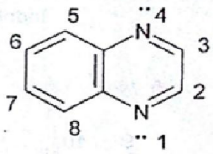
10-methyl-7*H*-pyrido[2,3-*c*]carbazole



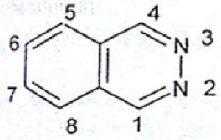
quinoline



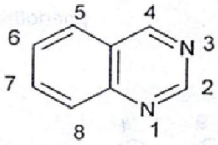
isoquinoline



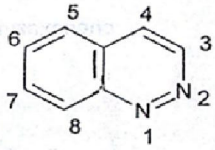
quinoxaline



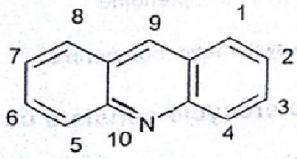
Phthalazine



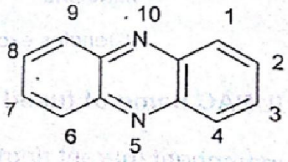
quinazoline



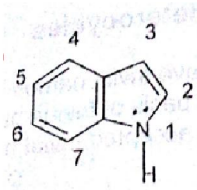
cinnoline



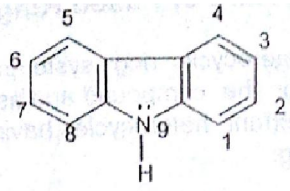
Acridine*



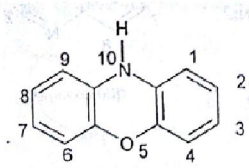
phenazine



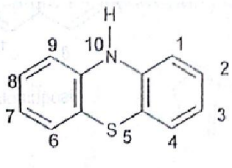
Indole



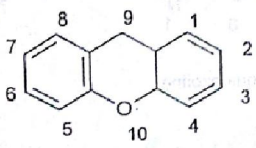
carbazole*



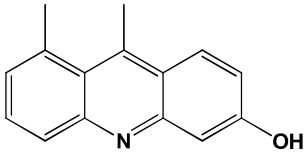
phenoxazine



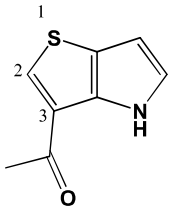
phenothiazine



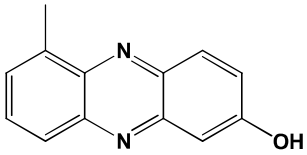
xanthene*



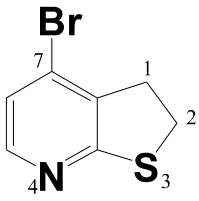
8,9-dimethylacridin-3-ol



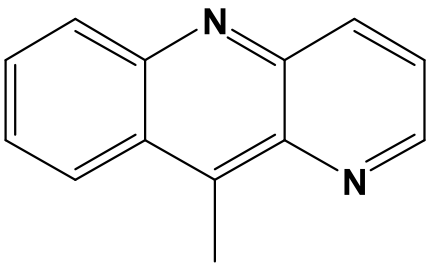
3-acetyl 4H-Thieno 3,2-b pyrrol



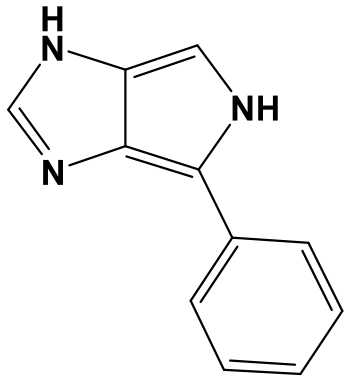
6-methylphenazin-2-ol



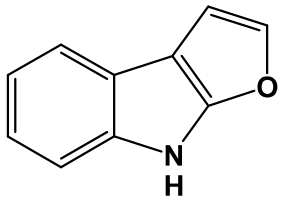
7-bromo- 1,2 dihydroThieno [2,3-b] pyridine



10- methyl pyrido [3,2-.b]quinoline

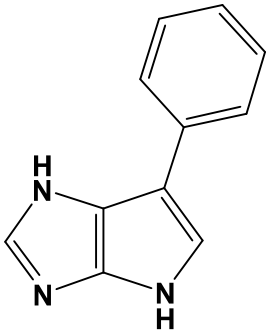


4-Phenyl-1,5-dihydro-pyrrolo[3,4-*d*]imidazole

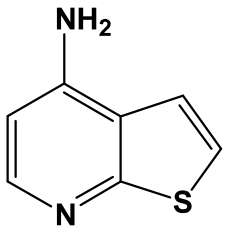


8*H*-Furo[2,3-*b*]indole

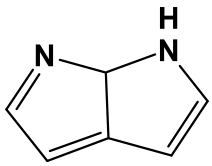
4*H*-Furo[2,3-*b*]indole



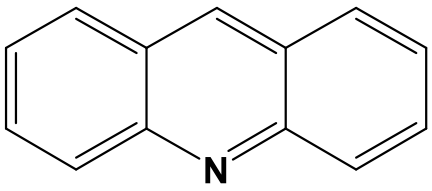
6-Phenyl-1,4-dihydro-pyrrolo[2,3-*d*]imidazole



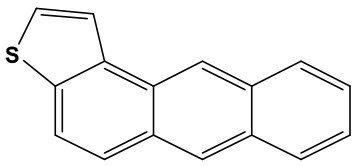
4-amino -Thieno[2,3-*b*]pyridine



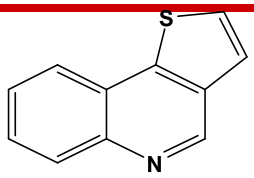
1,6a-Dihydro-pyrrolo[2,3-*b*]pyrrole



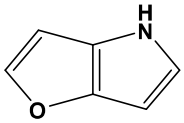
Acridine



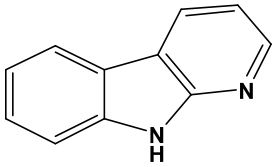
Anthra[2,1-*b*]thiophene



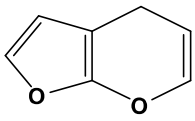
Thieno[3,2-*c*]quinoline



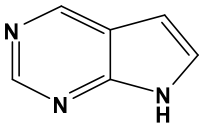
4*H*-Furo[3,2-*b*]pyrrole



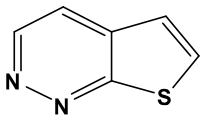
9*H*-Pyrido[2,3-*b*]indole



4*H*-Furo[2,3-*b*]pyran

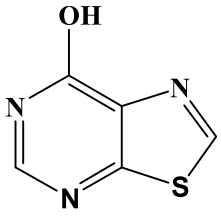


7*H*-Pyrrolo[2,3-*d*]pyrimidine



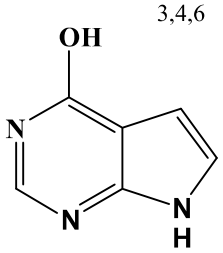
Thieno[2,3-*c*]pyridazine

1,3,5,7
2,4,5,7
1,3,5,7
1,3,4,6

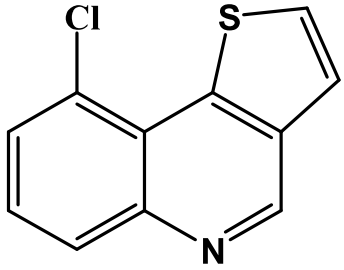


thiazolo[5,4-*d*]pyrimidin-7-ol

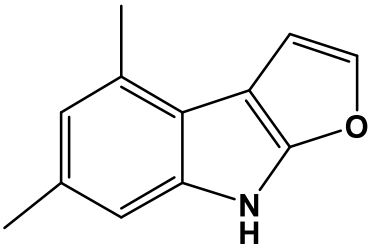
1,3,7
2,4,5
1,5,7
3,4,6

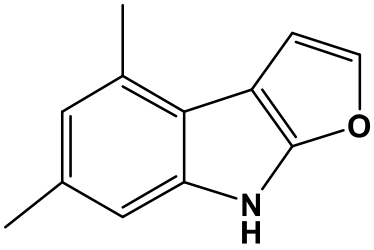


7*H*-Pyrrolo[2,3-*d*]pyrimidin-4-ol



9-Chloro-thieno[3,2-*c*]quinoline

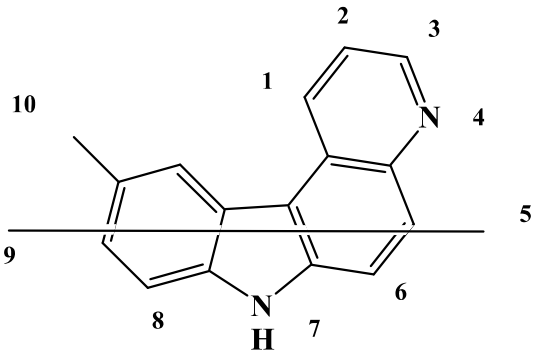




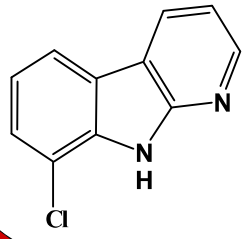
4,6-Dimethyl-8*H*-furo[2,3-*b*]indole

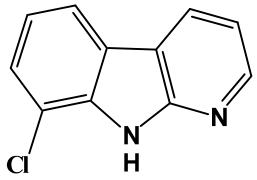
6,8 di metyl -4H- furo[2,3-b] indol

Number of substitued fused rings



10-methyl-7*H*-pyrido[2,3-*c*]carbazole

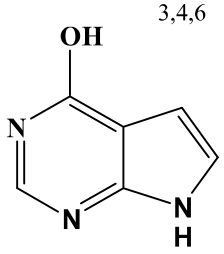




A -If there are several number for the hetero atoms ,we choice the lowest number

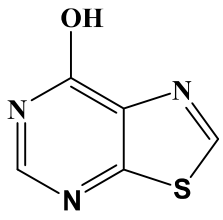
وبعدها نمشي مع عقارب الساعة اذا كان الرسم صحيح لكن نعتمد علياقل الارقام
الي يعطيك اقل ترقيم امشي بعدها

1,3,7
2,4,5
1,5,7
3,4,6



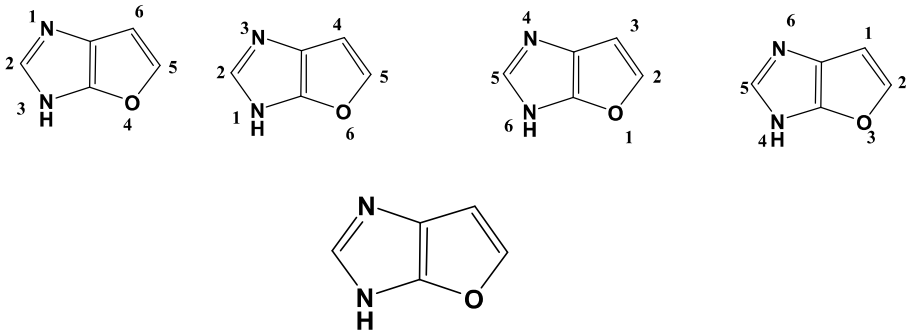
7*H*-Pyrrolo[2,3-*d*]pyrimidin-4-ol

1,3,5,7
2,4,5,7
1,3,5,7
1,3,4,6



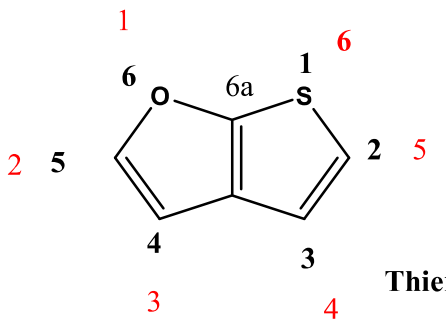
thiazolo[5,4-*d*]pyrimidin-7-ol

If there are several possible orientation in the coordinate systems
a,give the low number for hetero atoms



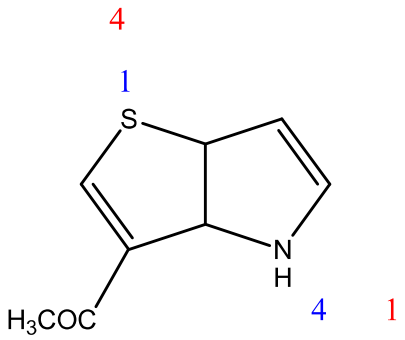
3*H*-Furo[2,3-*d*]imidazole

B. Give the lower number for hetero-atom in the order
O ⟹ S ⟹ N .If the hetero atom take the same numbe



1,6
1,6

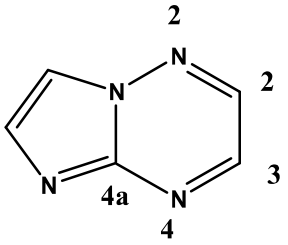
Thieno-[2,3-b] furan

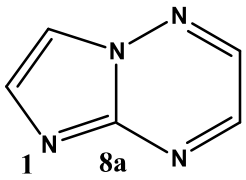


3-Acethyl-4H- Thieno[3,2-b]pyroll

C. Give the low number for fusion carbon

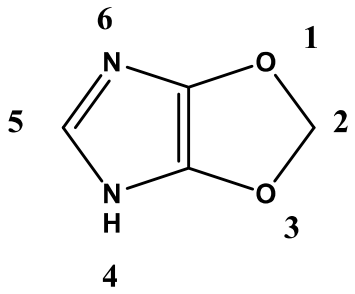
لو طلع في القاعده الاولي يحل المشكلة نكتفي بالقاعده الاولي





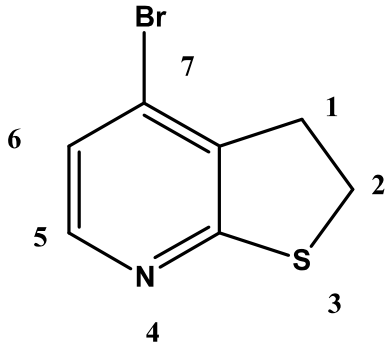
Imidazo[2,3-b] 1,2,4 trizine

d. Give the low number for saturated atoms

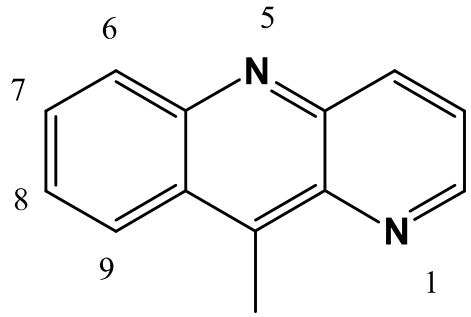


2,4-di hydro-1,3 di-oxolo[4,5-d]imidazol
not 2,6 di hydro

طبقنا القاعده الاولي اقل الارقام



7-bromo-1,2-dihydro-thieno[2,3-b]pyridine



10- methyl pyrido [3,2-.b]quinoline